DEPLETION OF THE JAVA SEA'S FISH STOCK, 1860'S-1990'S

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ABSTRAK

Penangkapan ikan laut merupakan salah satu kegiatan ekonomi yang penting di Ind onesia. Secara kultural usaha ini berkembang dalam wacana kemelimpahan kekayaan alam, seolah-olah sediaan ikan laut di Indonesia ada dalam jumlah yang sangat banyak. Artikel ini menolak pandangan tersebut. Berdasarkan data dari pantai utara Jawa, didapatkan bahwa sejak akhir abad ke-19 sediaan alami ikan di perairan pantai utara Jawa sudah mengalami lebih tangkap dan peningkatan hasil tangkapan sejak tahun 1960-an diperoleh sebagai hasil ekspansi wilayah penangkapan ke perairan di luar laut Jawa.

Kata kunci: nelayan - Jawa - sumber daya

INTRODUCTION

With total catch more than half million tonnes per annum in the 1990s, sea fishery along the northern coast of Java is an important economic activity for the island's population. Today, catch landing in Java is higher than ever. However there is a fact that before they started to enjoy increasing catch since the end of the Independence War, for almost seven decades the northern coast of Java fishermen experienced a declining and very poor catch. Detailed information on the catch landed by fishermen of the northern coast of Java during the last two centuries is presented in the discussion, but I will simplify it to show general tendency of catch landing from 1820s to 1990s in the following graph.

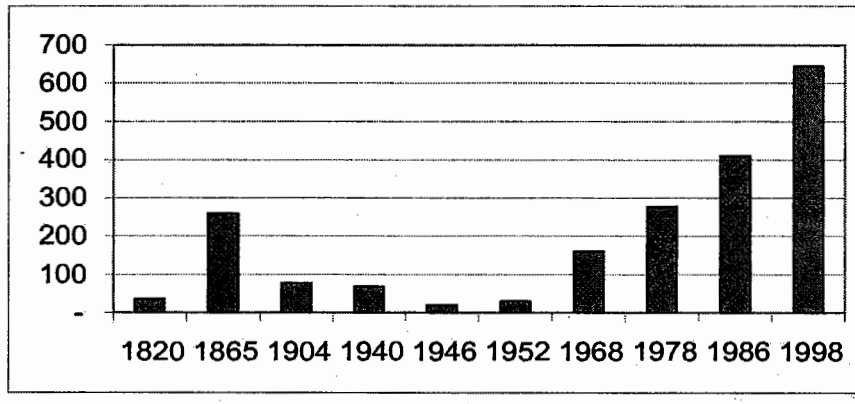

Figure 1. Catch landing along the northern coast of Java, 1820 - 1998

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The earliest quantitative data about northern coast of Java sea fisheries, which I can get from the1820s, is that of estimated number of the fishermen (Boomgaard, 1989: 117). By assuming that there had been no technological changes among the fishermen from the 1820s to the 1860s when the per capita catch is known, I dare myself to presume that the catch landing in the 1820s was around 36.000 tonnes per annum. For the next four decades, the northern coast of Java fishermen seemed to have enjoyed good years which invited more people to enter sea fisheries that their number and catch steadily increased until it reached 250.000 fishermen and 258.502 tonnes in 1865 (Masyhuri, 1995: 111). From then on the catch started to decline, down to 77.000 tonnes in 1904, 68.000 tonnes in 1940 and, around 20.000 tonnes at the end of the Japanese occupation . It just well after the Independence War that the fishermen catch started to increase again to 31.000 tonnes in 1952, 150.000 tonnes in 1968, which broke the 1865's record in 1978, and kept increasing to 410.000 tonnes in 1986 and 645.000 tonnes in 1998.

These dramatic changes in the fortunes of the Java Sea fishery immediately raise a number of questions. How was the increase in the catch during the middle decades of the nineteenth century achieved? What are the factors which caused the catch to decline at the end of that century? Is the natural stock of sea fish in the Java Sea, the 'traditional' fishing ground of fishermen from the north coast of Java, abundant enough to bear the exploitation pressures now being brought on it? These questions are critical. Since the last decade of the colonial regime, fishermen and government officials all alike have been crying about the need to increase the catch landing[1]. Natural stock of sea fish was not considered as a problem. In the government's estimation, maximum sustainable yield of fish in the Indonesian seas is not less than 6 million tonnes per annum. Everybody was carried by the idea of abundance of fish stock at sea, and how to achieve further increase of catch rather than how to conserve the fish stock[2]. The latest word is according to the officials of the Ministry of Maritime Affairs and Fisheries up to this time only 64% of marine resources potential of Indonesia has been exploited. More investment is needed to utilize the rest 36% which so far has been left idly at sea[3]. Are Indonesian seas really that rich? Is more capital injection really necessary? I will try to deal with these questions from the perspective of the northern coast of Java fishermen who traditionally exploit Java Sea, approximately 216.000 square miles which—according to official statements—offered 705.000 tonnes of sea fish to be caught annually without endangering its sustainability (Comitini and Hardjolukito, 1983).

The Increase and Decrease of Catch Landing in the 19th Century

The nineteenth century was the era when sea fishery in Java began to develop. Economic activities, which in the early decades of the century involved just few thousands fishermen in some fifty years had grown into a big business run by 250.000 fishermen producing 60 million guilders' worth of catch annually[4]. All the evidence would seem to indicate that the nineteenth century marked a decisive stage in the development of sea fishery in Java. This development in the nineteenth century can be explained by three following factors: first, a high demand for fish in local markets in Java. In early decades of the century 1,100 *pikul* (seventy tons) and two million pieces of fish were imported through the port of Jakarta, and 550 *pikul* (thirty-five tons) and 565,000 pieces through the port of Semarang. The second, availability of capital necessary to build up the fishing fleet improved the fish trading network, which was a consequence of the application of a tax-farming system in sea fishery. Taxes from the trading of opium and rice wine, slaughter of cattle, buffaloes and pigs, and on pawn shops, sea-fishing tax in the first half of the nineteenth century were collected by, mostly Chinese, tax farmers who in return were granted a right to claim 10 per cent of the fishermen's catch. Tax farming was a very profitable occupation, as it offered a good opportunity to gain a positive

balance between the amount of tax collected from the fishermen and the amount submitted to government. Apart from the right to collect tax, the tax farmers were also given the monopoly over fish and salt trading in their working area. Through their monopolies, tax farmers became the accumulators of wealth among the northern coast of Java fishermen. Boosted by their growing capital, the tax farmers moved further into providing fishing boats to the fishermen on credit while they also took care of the fish marketing (Masyhuri, 1995: 82-87). The third factor was the availability of a labour force willing to take up sea fishery. This was closely related to the introduction of the forced Cultivation System and the advent of big sugar plantations in Java, which had in effect instigated socio-economic problems among the agricultural villagers (Van Schaik 1996: 54). During the forced Cultivation System many agricultural villagers ran away from their villages and headed closer to the coastal areas in an attempt to seek a better place to live (Ricklefs, 1981: 116-7; Van Niel, 1972). Another cogent reason is that sea-fishing at that time offered a better income than in agriculture.

Although it was not the only fishing technique known by the fishermen, reports from the second half of the 19th century indicate that most of north coast of Java fishermen employed *payang* seine aboard *mayang* boat to catch pelagic fish[5]. *Payang* is a double winged seine with fish sack in the center. When cast into sea waters, the 320 meters long wings would form a circle fence. As each wing was pulled from boat deck the circle would get smaller until finally fish trapped inside the fence entered into the fish sack and taken aboard. *Payang* was quite productive and stood as the back bone of north coast of Java fishery, until finally the fishermen began to adopt purse seine in the 1970s[6].

I can not find detailed information on annual total catch among the northern coast of Java fishermen in the first half of the 19th century, but data from Pekalongan Regency reflects the general tendency of catch increase during that period (Semedi, 2001: 51). In 1828 tax farmer in Pekalongan Regency submitted *f* 3,360 sea fishing tax to the government, which then increased to *f* 6,960 in 1830 and kept increasing in the following year until it reached *f* 16,920 in 1863. The official tax rate at that period was around 10% from the catch, although it was common for tax farmers to draw more than that amount from the fishermen. Based on the tax rate, it can be calculated the fishermen's total catch both in cash and in natura since the average price of sea fish from that period is known.

Table 1. Estimation of Pekalongan Fishermen's Catch 1828 - 1860s

Year	Tax (*f*)	Catch (*f*)	Catch (*katie*)	Catch (tonnes)
1828	3,360	33,600	186,667	115
1830	6,960	69,600	386,667	239
1840	8,964	89,640	498,000	308
1850	12,060	120,600	670,000	414
1857	9,660	96,600	536,667	331
1860	9,720	97,200	540,000	334
1863	16,920	169,200	940,000	581

Source: Masyhuri (1996: 88); ANRI, Algemeen Ontvangen, 1849; Algemeen Verslag 1857 - 1864.

With total catch ranging from *f* 96,600 in 1857 to *f* 169,200 in 1863 apparently Pekalongan fishermen enjoyed a good income. Between 1857 and 1863, after their catch was reduced by 10% tax on average—regardless their position either as boat owners or deck hands—the fishermen got *f* 143 of gross income per annum. This number is close to the general pattern of Java. To Masyhuri's (1996: 110-1) calculation, in the early 1870s Javanese fishermen an average received *f* 180 of gross income per annum. Indeed, fishermen who bought their boats on credit from tax farmers would receive lower income since half of their catch had to be submitted as payment until the boats were fully paid—normally within two years. With such income, northern coast of Java fishermen's economic life was far better than that of farmers and plantation foremen who on average received *f* 70 and *f* 96[7].

Unfortunately by the 1870s sea fishery along the northern coast of Java had started to decline. The catch gradually decreased, the number of fishing boats went down, and the fishermen's income dropped. In the 1870s there were 15,000 fishing boats of three *koyang* (8.5 cubic metres) among the fishermen. Some three decades later the number had decreased to 6,000; while in the same period the annual catch of the fishermen dropped in value from 60 million guilders to 10 million guilders (Masyhuri, 1995: 132).

G.N. Verloop (1904) proposed an interesting explanation that the decline of northern coast of Java sea fisheries in the late decades of the 19th century was related to the tremendous eruption of Krakatau volcano in 1883. The eruption of which its bang could be heard in the Philippines, Alice Spring, and Madagascar had caused 40 metres high tsunami and turned the sky of Strait of Sunda area pitch black layered by volcanic ash. Such calamity should have must greatly upset the natural stock of fish and other forms of life in the Java Sea. This explanation is quite plausible, but reproduction rate of sea fish is extraordinary. Even if the eruption had wiped out almost the entire stock of sea fish in the Java Sea within a short period, the fish would have returned to its healthy stock as long as its natural growth was not hampered by human intervention.

To Masyhuri the decline of north coast of Java sea fishery was moved by economical cause rather than natural one. It was caused mainly by the abolition of the tax-farming system in 1864, which in turn forced the tax farmers to pull out of the fishing business. I agree that to some degree the abolition of tax-farming system must have affected sea-fishing performance along the northern coast of Java. At least it deprived the tax farmers of an important source of revenue as well as of their monopoly rights in fish trading and salt distribution. But after having played the sea-fishing barons for decades, many of them must have hoarded a fair amount of capital, and there was no reason for them to abandon the fishing business altogether just because they had been stripped of their taxation and trading monopoly rights. Even if, for some reason, they had had to withdraw from sea-fishing, it did not logically follow that they had to withdraw from their position as providers of capital and as fish dealers. Moreover, there were others to fill the vacant positions. Villages in nineteenth-century Java were heavily infested by all kinds of money lenders: Chinese, Arabs and natives (Ricklefs, 1981: 119), who would have been only too happy to take over the former tax farmers' profitable niche among the fishermen. Also some local, Javanese petty fish traders or would-be fish traders must have been only too glad to see the Chinese tax farmers leave their villages.

As I will discuss in the following pages, there are good reasons to hypothesize that nineteenth-century sea-fishing along the northern coast of Java declined not because there was no further capital investment, but because of depletion of the fish natural stock. It was not because the ex-tax farmers ceased to provide capital to the fishermen, which forced the sea fishery into bankruptcy, but the other way around. It was because the sea-fishing went bankrupt, that the ex-tax farmers and other capital owners stopped investing in sea-fishing, for there was no more

profit to be had from it. Catches in the first half of the nineteenth century were so good that they could provide the fishermen and boat owners with lavish income. Eventually scarcity of fish brought the fishery into a decline. The good catches in the first half of the 19th century had encouraged boat owners to buy more boats —in an attempt to make more money; and lured more people into becoming fishermen to share in the bounty of the sea. As a result, pressure on the fish natural stock along the northern coast of Java fishing grounds built up, until finally the carrying capacity of the fishing grounds was exceeded.

I am not saying that the depletion of fish stock occurred in the entire Java Sea. It just hit the northern coast of Java fishermen's fishing grounds, that of the waters along the northern coast of Java right from the coast line to 40 or 60 kilometres up north. Hardly more than that as fishing boat technologies at that period, that of wind and human muscle powered, limited the fishermen to sail not more than 60 kilometres—or 90 kilometres if we use H.C. Delsman's (1939) estimation—from coast line. Indeed if they wished they could go beyond that limit, but they would meet difficulties to sail back and reach the fish market before their catch started to rot.

Constrained by their fishing technologies, all the late 19th century Javanese fishermen could do to earn their living was intensifying their activities in already depleted fishing grounds. In the 1890s the northern coast of Java witnessed a vast spreading of beach fishing activities. Here and there bamboo fish traps (*sero*) were installed to catch fish and shrimp which roamed close to beach or entered estuaries and coastal marsh to spawn. In the meantime more effective fishing gears, as they were dragged by boats to scoop practically all sea creatures which happened to be in their way, were invented. They were *jala hela*, *jala krikit*, and *arad* (Van Kampen, 1909). In short, the fishermen were engaging in fishing activities which were not only poor in return as their catch mostly consisted of small sized and immature fish, but also detrimental to fish stock that government officials denounced it as *roofvischerij*, destructive fishing (Masyhuri, 1996: 156). It was in the attempt to prevent further destruction, both on the fish stock and the fishermen welfare, that in 1905 the Declining Welfare Commission (MWO, 1905: 21) urged the government to control fishing activities through; (a) seasonal closing of fishing grounds along the coastal waters and a temporary closing, for at least three years, of the waters of Jakarta Bay; (b) prohibition of any kind of net and seine with a mesh size of less than two cm; (c) prohibition on beach seine and fish traps in estuaries; and (d) prohibition of catching spawning fish.

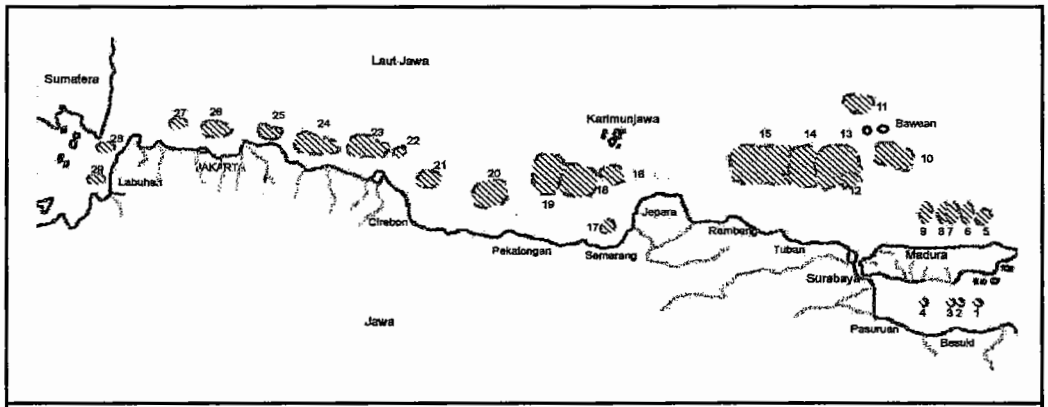
Further decline

Within more or less a quarter of century, sea fishing along the northern coast of Java had changed from a lucrative business to a poor subsistence activities. Verloop (1904) reported that average income among the fishermen in the 1900s was only one fifth of their income in the 1870s. My own calculation Pekalongan fishermen's average annual income was between *f* 53 to *f* 64 per annum in the 19005. Compared to income of agricultural villagers in their surrounding apparently Pekalongan fishermen's income was lower (Semedi, 2001: 65-6). In this situation what the fishermen should have done to avoid further decline was reducing their fishing efforts to give the fish stock a chance to recover. However, rather than reducing their fishing efforts what the fishermen did at the end of the nineteenth century was to split themselves into small working units to fish aboard small- sized boats. Through this strategy they could avoid the high investment required to buy larger boats and spread the risk of a bad catch as widely as possible. From a practical point of view, the small boats also helped the fishermen to provide jobs for the growing number of labourers in their community. Another trick engaged by the fishermen to get a good catch was by deploying *tendhak*, a strand of coconut fronds, to lure fish school. With he help of a weighing stone a *tendhak* put in certain

fishing spot. After the fish had shoaled around the *tendhak* the seine was cast (Van Kampen, 1909).

Apart from these moves, what the fishermen did to escape from fish stock depletion in 'their' fishing grounds was to intrude into the grounds of other fishing communities. By the turn of the century it was common practice among fishermen of every district along the northern coast of Java to poach on each other's fishing grounds. At that time expansion further north, beyond the 60 kilometres limit, was still not feasible, as the technology available to the fishermen had not changed very much from what they had had at their disposal half a century ago. Six months out of every year *mayang* fishermen from Tegal migrated to other waters; between February and April they went to Pemalang or even further east to Kendal and Semarang, while from June to September they went to Jakarta Bay. A more or less similar pattern was also followed by fishermen of other places. Pemalang and Comal district fishermen frequented Cirebon waters in the west and roamed as far as Jepara in the east (Van Moll and s'Jacob, 1913: 60).

At sea the fisehrmen were threatened by fish stock depletion, and on shore another menace loomed in the form of the money-lenders and the fish traders who were lying in wait for them. They took advantage of the scarcity of cash among the fishermen to buy the fishermen's catch up cheaply in advance and to lend money at high interest (De Wilde, 1911: 21). To help the fishermen, a set of programs to improve sea fishery was introduced by the government. In 1905 the Ministry of Agriculture established the Batavia Fishery Station, in Jakarta as a research center for fishery resources and fishing activities in Indonesia (Sunier, 1914). In the meantime credit for fishing sector were delivered through government banks to help the fishermen renovate and improve their fishing fleet. In the 1910s under initiative of F.W.M. de Rijk van der Gracht, Controller of Ministry of Interior in Tegal Regency, fishing organizations as socio-economic vehicle to improve the fishermen's welfare were established along the northern coast of Java (Besseling, 1913; DEZ, 1941). The government granted the fishing organizations with the right to run fish auction and credit service which in effect would free the fishermen from the claws of bad fish traders and money lenders. It seemed to save the fishermen and improve their welfare the government had



Source: Pel, 1883 cited in Masyhuri, 1995:49

Keterangan :
1. Jangkar
2. Panarukan
3. Blitok
4. Besuki
5. Kali Bunu
6. Ambunlan
7. Pasongsongan
8. Pasean
9. Tamboru
10. Kelapang sampai Ktapis
11. Waru
12. Kranji dan Waru
13. Blimbing
14. Ngaglik, Palang, Tambakbojo, Tuban
15. Bulu, Sarang, Kragan
16. Jepara
17. Moro Demak
18. Kendal dan Korowalang
19. Batang
20. Pemalang, Tegal
21. Dadap
22. Indramayu
23. Erofan
24. Panarukan, Clasem, Clamaya, Siprako
25. Pucuk, Muara Cina
26. Mayang dan Jakarta
27. Tenara
28. Anyar Lor
29. Labuhan

Figure 2. Fishing grounds of northern coast of Java fishermen, 1930s

done almost anything they could do, but unfortunately no measurement was taken to solve the most basic problem. Until the colonial regime came to its end in 1942, no single point of the Declining Welfare Commision's suggestions on fishing effort control was implemented.

In general it can be said that government policies in the sea fishery sector in the first half of the 20th century was mostly oriented to empower capital structure among the fishermen and to ease the fish trading paths. During the first half of the 20th century, through *Volkscredietbank* and other banks, an increasing amount of credit had been injected to fishery sector in Indonesia. In 1910 the banks in total delivered *f* 97.220 of credit, which increased to *f* 115.182 in 1913, *f* 354.348 in 1920, *f* 693.200 in 1925, and slightly lowered to *f* 603.300 in 1930 (Masyhuri, 1995: 194). Apart of credit from banks, especially in northern coast of Java, there were also credits from fishing organizations. Indeed not all the credit were delivered to the fishermen, some of them were handed to fish traders to increase their trading capital and to stabilize their cash flow. Meanwhile, some credits which fell to the fishermen's hands were used for consumption, too. Nonetheless, the credit remain capable to produce great impact to the development of fishing fleet in the northern coast of Java that in 1938/39 alone it allowed the fishermen to buy 343 new fishing boats or 5.8% from total number of boats in the fleet.

Apart from the credit schemes, in the 1920s the fishermen witnessed a new development in the form of adoption of the very productive mechanized boats. By 1929 in the form the fleet to two Japanese fishing companies Jakarta which operated 6 mechanized boats, which increased to 12 boats some two years later. At that time, the Dutch fishing companies owned two of large-sized and a number of small-sized mechanized boats. In 1934 the fleet was augmented with a number of boats powered with 60 HP engines, and 22 boats powered with 10 to 36 HP engines. Outside Jakarta some Javanese fishermen succeeded to get mechanized boats too (DEZ, 1941: 16). To C.J. Bottemanne's (1959) calculation a *mayang* boat powered with 6 HP engine could bring in 35 tonnes of catch per annum, three times higher than the catch of sail powered *mayang* boat of the same size. On average fishing boat with 50 HP engine could produce 200 tonnes of catch per annum. Out of 2.000 tonnes catch in Pasar Ikan port of Jakarta in 1931, a quarter of it, 500 tons, were landed by the few Japanese fishermen with their mechanized boats, while the bulk of Javanese fishermen with hundred of sail powered boats brought in just 1.000 tonnes (Masyhuri, 1995: 269)[8].

The thing is, both credit program and mechanized boats failed to increase total catch among the fishermen. Bottemanne and Statistic Bureau claimed that catch landing along the northern coast of Java was 100.000 tonnes in 1940, but I think this number is too high[9]. DEZ's (1941: 48-51) data shows that catch landing in Jakarta and surrounding area, Cirebon Residency, and Central Java

Table 2. Credit for boat owners in Java, 1936 – 1940

Year	Credit *f* (1.000)	Usage of credit		Number of boat in the fleet
		To buy new boats	To buy 2nd hand boats	
1936	58.966	(29.27%)	(3.48%)	
1937	40.700	-	-	-
1938	34.200	-	-	5.957
1939	44.300	343 boats	247 boats	6.257
1940	48.700	421 boats	295 boats	6.750

Source: Masyhuri, 1995: 233; DEZ, 1941: 58-9

Table 3. Catch landing 1904 and 1937 - 1940

Year	Ton				f (000)
	Jakarta	Cirebon and Central Java	East Java	Total	
1904	-	-	-	76.935	18.000,0
1937	16.789	18.359	18.359	53.507	3.424,4
1938	18.432	18.756	18.756	55.944	4.027,7
1939	19.254	22.370	22.370	63.994	4.415,6
1940	19.205	24.615	24.615	68.435	5.132,6

Source: DEZ, 1941: 48-51)

Province in 1940 was 44.985 tonnes. This amount must be added with data from East Java Province which for the moment is not available to me. However, considering fishing activities in those areas were more or less similar to Central Java Province and Cirebon Residency, it is quite safe to assume that catch landing in East Java Provinces was more or less equal to the Central Java's.

With 68.000 tonnes 1940's total catch was still 8.000 tonnes below that of 1904's. Apparently introduction of the productive mechanized boats had not yet capable to increase total catch in the 1930s. Reports from the 1930s mentioned that mechanized boats in Jakarta were operated inside the Jakarta Bay waters or around Seribu Islands corral reef (Masyhuri, 1995: 249-53). Installation of obsolete 1920s engine apparently only helped the fishermen to move swiftly from one fishing spot to another or to chase fish school, but had not yet allowed them to enlarge boat size so they could have closed compartment aboard to preserve their catch with ice or salt (Bottemanne, 1946: 20). Without capability to preserve their catch, the fishermen—with mechanized boats or not—were bound inside waters not more than 60 kilometres from coastline and could not sail further north to exploit fresher fishing grounds[10].

Introduction of mechanized boats, therefore, just led the fishermen into stiffer competition over already depleted stock of fish in limited fishing grounds. When, as the report says, fishermen with mechanized boats brought in good catches, they did so by "reducing" catch portion for fishermen with sail powered boats. Both of them worked in same fishing grounds and often were after the same target species, so gain of one side could only mean loss for the other. For fishermen with sail powered boats good catch was hard to get and slack season became harder and perhaps longer too. Even among them a stiff competition also occurred between fishermen of big fishing boats with smaller sized boats. In Pekalongan Regency almost 40 per cent of the annual catch between 1938 and 1940 was landed by large-sized boats which made up only 25 per cent of the fleet. On average each large-sized boat landed seven tons of catch in 1940, while other, smaller, types of boat landed only 1.5 tons. On top of this, since the 1920s, fish price in Java decreased steadily from *f* 230 per ton in 1923 down to f 65 per ton in 1940 (Masyhuri, 1995: 273). The effect is obvious, the fishermen's income went down. In the late 1930s, deck-hands of large *mayang* boats in Pekalongan received an annual income of between *f* 12 to *f* 15; while the owner earned *f* 97 to *f* 122 (Semedi, 2001: 83). Compared to the 1900s, annual revenue of Pekalongan fishermen in the late 1930s was worse. Revenue of *mayang* owners declined from *f* 269 to *f* 122, while revenue of deck-hands dropped from twenty-seven to fifteen guilders. Average annual income of the fishermen, regardless of their type of boat and position, dropped from *f* 53 to *f* 47. Compared to the income earned by sugar plantation labourers and peasants who lived around sugar plantations, the income of Pekalongan fishermen in the late 1930s was lower. On average garden labourers, the

lowest level of workmen, on a sugar plantations at that time earned *f* 4.01 wage per month or *f* 48.12 per annum, while peasants got roughly *f* 72.36 per annum (Huizenga, 1958: 74).

After the Independence

During the three and half years of Japanese occupation, it was extremely difficult for the fishermen to keep boats and fishing gear in a good shape. Sail cloth, rope, fiber, and other material needed for routine maintenance of fishing equipment were hard to find. As the result, many boats were put out of business. When the Japanese left in 1945 approximately 20.000 boats or one third of Indonesian fishing fleet were in total disrepair and catch landing all over the country was only half of the 1940's[11]. In Java the catch must be lower since mechanized boats the main contributor of the 1930s' catch were probably totally gone during the Japanese time. Perhaps the catch was as low as 20.000 tonnes. Independence War which lasted until 1949 must have affected the fishermen work too, but it seemed the situation was an improvement as compared to the Japanese time. In Semarang and many other areas fishing activities were almost back to normal pace, and fish markets were open regularly[12].

After a decade of turmoil, in the early 1950s sea fishery in Java began to recover, but catch among the fishermen remained low. Along the northern coast of Java the fishermen landed I just 31.000 tonnes of catch in 1951 (BP, 1952, No 1-3/4). To increase the catch, Indonesian government continued the pre-war policy of fishing boat mechanization. The first wave of mechanized boats came to post-war Indonesian fishermen in 1951. In that year the fishermen received 200 motor boats as a loan from ECA (Economic Co-operation Agency), each priced at US $ 6.600 or Rp 90.000 and was to be manned by sixteen crew members (BP, 1951, No .3). The plan was, in 1952 there would be further loans in the form of 2 large-sized and 40 smaller-sized tuna clippers for Eastern Indonesia, 10 trawlers for Kalimantan, 33 fish carriers to collect fish from all over the country, and 345 mechanized *mayang* boats for northern coast of Java (Siswosoebroto, 1952: 17). The plan seems to be worked out, within five years number of mechanized boats in Indonesia increased steadily from around 100 in 1951 to 750 in 1956 (Krisnandhi, 1969: 51). By 1955 shipyards in nort coast cities were busy to build 14 metres long, wooden hulled boats, powered by a 25 HP diesel engine[13]. The boats were then made available to the fishermen through credit programme. By early 1960s almost every fishing community along the northern coast of Java had received their share of mechanized boats, although the number was still too limited to accommodate the whole fishing labours.

With the 14 metres long mechanized boats, which were large enough to be equipped with ice compartment to keep their catch fresh, the fishermen could expand their fishing ground 70 kilometers from the coast line, well beyond the 'traditional' 60 kilometres line, and reaped plentiful catches (Siswosoebroto, 1951). However, it seems this new fishing grounds did not last very long. As the number of mechanized fishing boats increased, total catch among the fishermen in the first half of 1950s tripled from 30.000 tonnes in 1952 to 90.000 tonnes in 1955. From then on, total catch kept increasing but not as high as the rate of mechanized boats number. The boats number increased by 250%—from 123 in 1955 to 308 in 1960—but total catch mereased only by 10%.

How come augmentation of mechanized fishing boat number failed to jack up catch significantly? I think the answer is quite simple, because there was no more fish to be caught. In other words, very likely within A merely ten years the fresh fishing grounds north of the 40 kilometers 'traditional' fishing grounds, had been exhausted. In the late 1950s reports came up that catch of *lemuru* (Sardinella allecia) in Strait of Bali had declined sharply from 6.600 tonnes in 1950 to merely 500 tonnes in 1957 (Soemarto, 1959). It seems, however, no serious attention was paid to this phenomenon. The fishermen dealt the stagnation of catch in the last years of 1950s by stretching their mechanized

Table 4. Fishing fleet and total catch of Java, 1955-1961

Year	Number of boat			Number of Fishermen	Total catch (tonnes)
	Sail powered	Mechanized	Total		
1955	28.850	123	28.973	165.722	90.846
1956	28.978	191	29.069	154.406	93.233
1957	30.000	254	30.254	175.000	106.195
1958	33.824	254	34.178	216.218	114.779
1959	33.047	288	33.135	215.672	104.992
1960	29.261	308	29.569	223.377	99.078
1961	37.145	305	37.450	230.013	-

Source: BPS, 1963

boats' operation range—thus expanding their fishing grounds further north. In the 1960s it was common among Pekalongan fishermen, for example, to fish in Karimun Jawa waters, some 12 to 18 sailing hours northeast of Pekalongan. Duration of their fishing trip was increasing too, from one day to two days and eventually to three days at the end of 1960s. This effort proved to be fruitful. By 1965 – 1967 total catch among the northern coast of Java had risen to 150,000 tonnes (Krisnandhi, 1969: 54).

Annual total catch among the northern coast of Java in the second half of 1960s was well above the 1900s' but the amount remained too small to provide good income to the fishermen. Catch per capita among Javanese fishermen in 1965 - 1967 was only 475 kilograms—150.000 tonnes of fish contributed by 316.000 fishermen—which was equivalent to 600 kilograms of rice (Krisnandhi, 1969: 54). Say the fishermen's oldest son already involved in fishing and enjoyed similar amount of income, and the fishermen's wives from miscellaneous jobs could contribute 100 kilograms of rice per year (Semedi, 2001: 103), this would make fishing household gross annual income equal to 1.300 kilograms of rice[14]. If we take a moderate number that every fishing household consisted of six members then their income per capita was equivalent to less than 216 kilograms of rice. This rate was still below Sajogyo's poverty line standard of 240 kg rice per capita—120 kg to cover food subsistence and the other 120 kg to cover other economic necessities (Sajogyo 1996: 3).

Modernization of Fishing Fleet and Expansion of Fishing Grounds, 1970s –1990s

As the New Order regime took power, sea fishery was opened millions of dollars was to foreign and domestic investors. Within a relatively short period millions of dollars was injected to sea fishery, to buy mechanized fishing boats of small, medium, and large-sized, to improve fishing ports facilities and fish markets, and to build cold storage. All over Indonesia, from 1969 to 1976 not less than US $ 64 million had been invested in sea fishery by large fishery enterprise (Comitini and Hardjolukito, 1983:17). Apart from that amount the Indonesian government provided billions of rupiah of credit to small-scale fishermen to replace their old, sail powered, boats with mechanized ones (Direktur Jenderal Perikanan, 1974; Bailey, 1987a: 97-8). Out of 257.000 fishing boats in Indonesia in 1975, 5.8% or 15.000 boats were mechanized (Betke, 1985). Better fishing technologies—bigger boat size, stronger engines—enabled north coast of Java fishermen to expand their fishing grounds to distant waters far beyond their father generation. The management of thn father's generation[15]. The result is total catch among the fishermen increased steadily from year to year. By 1968, the total catch in Java had reached 159.000 tonnes and surpassed the 1865's record as in 1978 the catch rose to 277.000 tonnes (DGF, 1971; Comitini and Hardjolukito, 1983). This achievement was, again, reached through fishing grounds expansions[16].

The backbone of the modern medium and large-scale fishing in the northern coast of Java is purse seine. They are based on large fishing ports of Java such as Juana, Tegal, and Jakarta, but mostly are based in Pekalongan (Dwiponggo, 1987: 29; Roch, Durand, and Sastrawidjaja, 1998). Purse seine is an advanced and more efficient version of the traditional *payang*, which had been dominating north coast of Java fishery for more than a century. Just like *payang* purse seine is oriented to catch pelagic fish, and just like *payang* seine too, purse seine was proven capable to deplete fish stock at a very fast pace.

Table 5. North coast of Java fishing fleet, 1968 – 1996

	Year				
	1968	1971	1978	1986	1996
Catch (ton)	159.736	134.994	276.920	410.276	645.387
No. of fishermen	-	225.104	232.580	302.922	472.298
No. of boat	39.854	43.259	52.564	50.374	58.844
1. Non-mechanized	39.393	42.481	48.323	21.190	11.132
2. Mechanized	461	768	5.241	29.184	47.712
a. Outboard engine	-	-	2.132	27.232	43.673
b. Inboard engine	-	-	2.109	1.952	4.039
- > 5 GT	-	-	216	763	671
- 5 – 10 GT	-	-	568	282	1.016
- 10 – 20 GT	-	-	751	374	357
- 20 – 30 GT	-	-	390	292	406
- 30 – 50 GT	-	-	153	240	455
- 50 – 100 GT	-	-	24	1	986
- 100 – 200 GT	-	-	7	0	148
Outermost fishing grounds	North coast of Java and Karimun Jawa Islands waters	Bawean and Kangean Islands waters	Masalima, Masalembo Islands waters, and Strait of Karimata	Strait of Makassar and Southern part of Natuna Sea	Strait of Makassar, Arafura Sea, and South China Sea

Sources: DGF, 1970 – 2000

Development of the northern coast of Java fishery since the 1970s has been marked by boat mechanization and the fishing grounds expansion. Mechanized boats would give the fishermen a wider operational range in order to achieve a fuller exploitation of offshore resources, and at the same time reduce fishing effort on already heavily exploited inshore fishing grounds (Bailey, 1987a: 96). From Table 5 we can see how from 1968 to 1998 the number of mechanized fishing boat along the northern coast of Java greatly increased from merely 461 to 29.184. The size of the fishing boats had been growing too. In the early 1970s the mechanized fishing boats were mostly 5 to 10 gross ton in size, but some five years later the fishermen already deployed a great number of boats of 20 gross ton up, and by 1998 the majority of the inboard engined fishing boats were above 20 gross ton. This increase in boat size is enabled the fishermen to fish in distant waters.

In the early 1970s most of Pekalongan purse seiners fished in the waters north of Pekalongan up to Karimun Jawa islands on trips lasting a maximum of three days. By 1975 fish stock in Pekalongan waters had been depleted, the fishermen then intensified their fishing activities in Karimun Jawa waters and the time spent on the sea increased to a week per trip. In other words, the 300 thousands tonnes of catch brought in by the northern coast of Java fishermen in the mid 1970s were taken from a fishing grounds wider than the 1865's. Within four to five years the fish stock in Karimun Jawa waters was depleted too and the fishermen moved

further east to waters of Bawean and Kangean Islands (Sujastani, 1981). Their fishing trip already lasted for two to three weeks (Suherman and Sadhotomo, 1985). This pattern kept going on, and nowadays to get sufficient catch large-sized Pekalongan purse seiners have to fish in Natuna Sea and southern part of South China Sea on the north-west, and in Strait of Makassar and western part of Arafura Sea on the east, and duration of their fishing trip has expanded to ten weeks (Nurhakim *et al*, 1998).

Vast-scale mechanization and fishing ground expansion has led the northern coast of Java fishermen to a level of catch landing which never been reached before. By 1998 total catch among the fishermen was as high as 645.000 tonnes. With such level of total catch, the fishermen, especially who worked aboard purse seiners, enjoyed good income. On average they received between 1 to 1.5 million rupiah in 1993 – 1994, well above Javanese farmers who on average received between 0.5 to 0.9 million rupiah (Roch and Sastrawidjaja, 1998). However this achievement was reached through all out efforts and steadily growing fishing cost. More capital were had been invested to buy bigger and more powerful fishing boats, fishing trips became longer, and greater amount of fishing supplies were required.

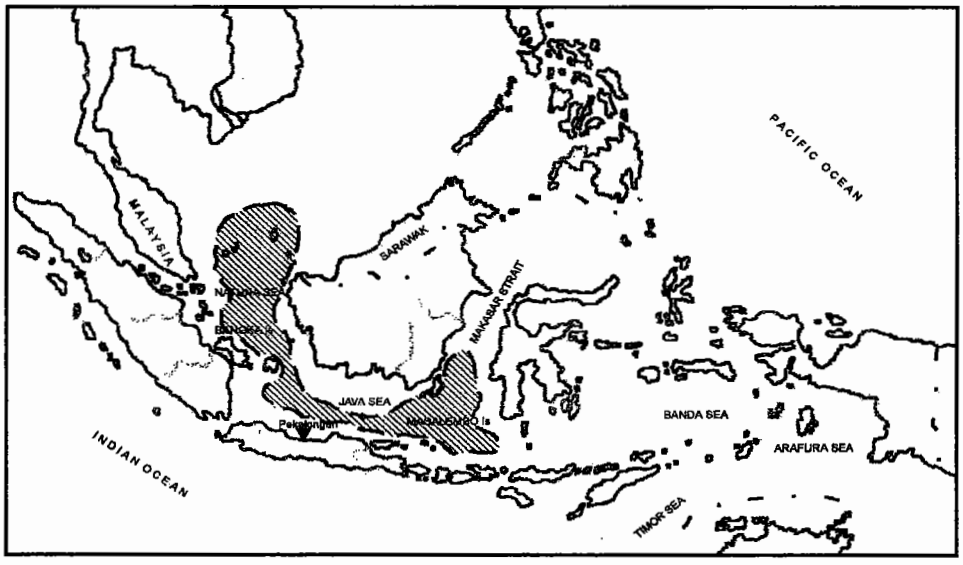


Figure 3. Pekalongan fishermen's fishing grounds 1990s

Table 6. Average catch landing and fishing supply for all vessel at Pekalongan fishing port, 1985-1989

Year	Catch		Fuel	Lubricant	Ice	Salt	Total
	Ton	Rp (mill.)	(ton)	(litre)	(ton)	(ton)	(Rp. mill.)
1985	16.6	5.41	3.3	11	17	0.04	1.1
1986	17.3	5.95	3.6	46	31	0.56	1.9
1987	14.8	6.12	4.2	42	25	2.92	2.1
1989	17.9	7.69	4.9	46	22	5.57	2.4

Source: Mc Elroy, 1991

The worse, however, was still to come. As early as 1985 there had been tendency of catch decline at fishing boat level. On average annual catch per fishing boat in Pekalongan port had dropped significantly from 216 tonnes in 1985 to 211 tonnes in 1986 to 132 tonnes in 1987 and to 135 tonnes in 1989 (Mc Elroy, 1991). Other report (Nurhakim *et al*, 1998) conveyed a similar message that catch per fishing unit among large-sized purse seiners had declined from 2,3 tonnes per fishing day in 1991 to 2,2 tonnes per fishing day in 1994. While among medium-sized purse seiners the rate was from 1,7 ton per fishing day in 1992 to 1,1 ton per fishing day in 1994. It seems that the increase of catch among the northern coast of Java in the second half of the 20th century is not much different to the increase in the first half of the 19th century, in that it will not last for long.

Closing Remark

The discussion above shows us that, apart from market demand and availability of human labour, capital is important in sea fishery. Availability of capital allowed the fishermen both in the 19th and 20th century to develop their fishing fleet, and increased their catch landing. However, without control on fishing effort there is always a danger of overcapitalization. Sea fish is a common property, and fishermen are concerned themselves with exploiting sea fish rather than conserving it (Brox, 1990; Osseweijer, 2001). Unrestrained by property rights, fishermen are driven to act selfishly by trying to catch as many fish as possible for their individual profit benefit. Garret Hardin's (1968) tragedy of the commons is the eventual outcome of this economic practice.

To increase their individual profit benefit, in the first half of the 19th century the northern coast of Java fishermen invested more and more capital that eventually catch capability of the fleet exceeded the fish stock's carrying capacity. Contrary to Masyhuri's view, in my opinion catch decline which hit the northern coast of Java in the last quarter of the 19th century was not because of lack of capital but because there was too much capital, that the fish stock could not bear it. In this situation, injection of more capital to buy more boats to jack up catch landing would not work. The same thing happened in the first half of the 20th century, adoption of mechanized boats failed to increase the catch, not because the boats were not effective but because there were no more fish to be caught.

Sharp catch increase since the 1950s does not disqualify the view above, because it was gained through fishing grounds expansion. Without the expansion there would be no catch increase for the fishermen. Apparently, estimation of fish stock in the Java Sea was too optimistic. The stock has long been depleted. In the late 1960s from a wider fishing grounds with bigger and more advanced fishing fleet the fishermen were able to bring in 160.000 tonnes of catch annually, far lower than catch in the 1860s. So where is the 705.000 tonnes of fish the Indonesian officials promise can be taken from Java Sea? Does it really exist at sea, or just in their imagination? Why do the fishermen fish in distant waters if fishing grounds next to home are still rich with fish? As sure as death and tax, if the 705.000 tonnes really exist in the Java Sea there would be no reason for the northern coast of Java fishermen to fish in Natuna Sea, the southern part of South China Sea, and Strait of Makassar, which so far just produced 645.000 tonnes. A close, more detailed, long term observation needs to be carried out to check the economic status of the north coast of Java fishery. Very likely it has been run as a losing business, where more and more investment is injected for a less and less gain, and its survival depends on heavy subsidies.

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1 Bottemanne, 1946: 23; Joedo, 1951; Siswosoebroto, 1952: 11; Suara Merdeka, March, 15, 1969; May 19, 1970 ; Nov. 21, 1997 ; Bailey, 1987b: 6.

2 Delsman, 1939; Siswosoebroto, 1952: 11-2; Berita Perikanan , No. 1-2, 1959; Comitini and Hardjolukito, 1983; Suara Merdeka (SM), Oct. 28, 1996

[3] National Coordination Conference of the Ministry of Maritime Affairs and Fisheries, Jakarta 30 May, 2002.

[4] Raffles, 1982, I: 186; Boomgaard,1989: 117; 1991; Masyhuri, 1995: 111

[5] Based on their habitat sea fish are categorized into pelagic and demersal. Pelagic fish takes the mid and upper layer of sea waters as their habitat, while demersal fish live close to the sea floor.

[6] Van Kampen, 1909; Bottemanne, 1946; Siswosoebroto, 1952.

[7] Boomgaard, 1989: 176-7; ARA, Cultuurmaatschappij Djolotigo.

[8] R. Pranjoto calculated with same type of gear a mechanized boat was nine to ten times more productive than sail powered one (BP, 1959. No 2).

[9] Considering the fishing fleet condition at that time hundred thousands tonnes of catch is too high. This level was just reached by the fishermen in the 1960s when large number of their boats were already mechanized.

[10] My observation in the 1980s and 1990s shows that fishing boats powered with 20 HP engine were rarely operated beyond 40 kilometres from coastline (Semedi, 1989; 1991). Indeed they could be sailed further north, but it would constrain the fishermen to reach fishing port before the closing of market hour.

[11] Dept. Penerangan, 1965, VII: 763; NIG, 1947: 84; Siswosoebroto, 1951.

[12] ARA, Bestuurs Verslag, Semarang 1948, 1949.; Berita Perikanan No. 6-9, 1950; No. 9-10, 1950

[13] SM, April 26, 1955.

[14] The actual income was lower than this rate, since a catch must be deducted by fishing supply first before shared among the fishermen. Among deckhands households the rate was further lower for their share was one third of skipper's and one fifth of boat owner's.

[15] Yet not all of them involved in the expansion. A good number of fishermen, who unable to lay their hands on medium and large-sized mechanized boats were left behind to fish in the old, already depleted, fishing grounds.

[16] Without fishing grounds expansion cath increase would not take place. My observation in Wonokerto fishing village shows that catch taken from the village's 180 kilometers square fishing grounds in the 1930s by sail powered boats were not different to catch in 1980s when it was taken by mechanized boats, that of around 1.000 tonnes per annum (Semedi, 2001: 81, 156).

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